NASA TECH BRIEF

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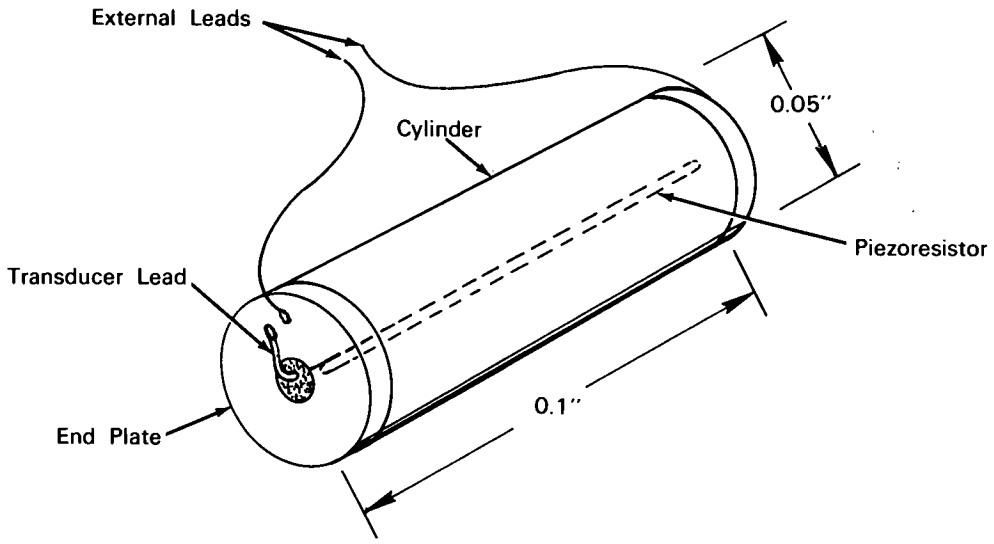
Miniature Stress Transducer Has Directional Capability



The problem: The measurement of stresses internal to a mass and, especially, along the direction in which they are oriented.

The solution: A miniature stress transducer that employs a semiconductive piezoresistive element that is stress sensitive along a specific axis only.

How it's done: A semiconductive transducer is fashioned from a p-type silicon splinter embedded in a centerless ground, high-density, polyethylene cylinder. The silicon splinter is a piezoresistor grown in a selected crystallographic orientation to possess piezoresistive characteristics along a selected axis. Brass end plates, drilled for the transducer leads, are fastened to the transducer cylinder ends using an epoxy adhesive. The assembly is held in a fixture while epoxy adhesive is injected into the cylinder to embed the silicon splinter permanently. The transducer leads are resistance welded to the brass end plates that include external leads for connection to instrumentation.

The mechanism of measurement is based on the compressive deformation of the transducer. Loading of the transducer cylinder along the piezoresistor's sensitive axis changes resistance of the silicon splinter in direct relation to the amount of stress applied. Various deformation sensitivities are possible by using cylinders of differing Young's modulus.

Notes:

1. Other cylinder materials which exhibit the characteristics of homogeneous structure, low modulus, nonconductivity, ease of machining, and good bonding to the semiconductor crystal have been found to be suitable, e.g., etched teflon.

(continued overleaf)

2. Materials having poor bonding qualities, e.g., nylon, were found to be unsatisfactory.
3. A number of transducers may be readily mounted about a point region in a structural member, each aligned with a direction of interest, thereby obtaining multiaxial stress analysis of the point region.
4. This transducer would be useful for constant monitoring of stress in structural members of buildings, dams, etc.
5. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Jet Propulsion Laboratory
   4800 Oak Grove Drive
   Pasadena, California, 91103
   Reference: B65-10023

Patent status: NASA encourages the immediate commercial use of this invention. Inquiries about obtaining rights for its commercial use may be made to NASA, Code AGP, Washington, D.C., 20546.

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